Remarks/Arguments:

Claims 3, 12 and 24 have been amended to address the Examiner's rejections based upon 35 USC 112; Claim 1 has been amended to overcome the Examiner's rejections based upon prior art; Claims 7 and 8, which depend from Claim 1, have been amended to eliminate an editorial discrepancy with Claim 1; and new Claims 35-39 have been added to more fully cover the aspects of applicants' invention. Accordingly, reconsideration is requested since none of the prior art discloses the present invention.

More particularly, Claim 1 has been amended to specify the alloy formula to include Hf (hafnium) as the 'a' constituent to overcome the various prior art rejections based upon Lin, Senkov and Xing, respectively.

The teachings of Lin, U.S. Patent 5,797,443, formulate several families of metallic glass compositions having both similar elements and atomic percent ranges as those presented in the current application. However, there is no indication for the relative abundance of each component, as set forth in claim 1. Furthermore, unlike the current application, Lin provides no indication of the chemical interrelationship between the primary (i.e., Hf-Cu-Ni) and secondary components (i.e., Al, Ti or Nb). The novelty of the present invention is exactly this fact (paragraph |0024| of the current application). The Hf-Cu-Ni ternary subsystem within the quinary metallic glass composition is unique; there is no equivalence to the Zr-Cu-Ni subsystem of Lin. It is possible that substitution of Hf or any other elements would yield 'obvious' density increases. However, substitution modifies the chemistry of the alloy such that the resultant composition is no longer a glass former. That is, the ratio of the glass transition to the liquidus temperature will not be 0.59, but considerably lower. Lastly, the liquidus temperatures of the present quinary alloys (980°C or higher) are well above those suggested by Lin (i.e., 660°C); such high temperatures cannot be achieved without complete Hf substitution of the base Zr-based alloy. Accordingly, Claim 1 is considered patentable over Lin.

The teachings of Senkov, U.S. Patent 6,623,566, relate to the metallic glass formation of a combination of elements entirely based on a topological (i.e, relative atomic radius size) relationship that attempts to create an efficient multi-component closed-packed system, wherein the packing of dissimilar atoms is random, thus amorphous. The argument assumes that the instability of the crystalline structure arises from the size mismatch of the elements that remain chemically inert. The optimization procedure neglects any chemical short-range interaction between the components. If applied to the Hf-Cu-Ni ternary system, it would not result in a glass forming alloy composition. The special invariant point found in the quinary Hf-Cu-Ni-Ti/Nb-Al system, more specifically, in its ternary Hf-Cu-Ni subsystem, forms the basis of the present invention. As such, it defines the plexus of a complex crystalline phase assemblage which could not be prima facie predicated from the teachings of Senkov et al. Accordingly, Claim 1 is considered patentable over Senkov.

The teachings of Xing, U.S. Patent Application Publication, 2002/0036034 are similar to those put forth by Lin. The chemical interaction between the primary components of the quinary alloy, namely Hf, Cu, and Ni are not disclosed or taught in Xing. Further, that chemical relationship as well as the fixed relative ratios of Hf, Cu, and Ni results in the unexpected advantages achieved by applicants (better glass forming alloy at higher density) are not within the disclosure or teachings of Xing. Accordingly, Claim 1 is considered patentable over Xing.

Claims 2-15 and 30-31 depend from Claim 1 and are considered patentable over the prior art of record for the reasons given in support of the patentability of Claim 1 as well as for the additional recitations contained therein.

It is noted that Claims 16-29 and 32-33, which are directed to a metallic glass alloy including hafnium, copper and nickel have not been rejected based upon prior art.

New Claims 35-39 are directed to a family of Hf-based metallic glasses based on an experimentally determined invariant point in the Hf-Cu-Ni ternary system. The downselection and specificity of the combination of elements in the Hf-Cu-Ni ternary system is claimed herewith. That is, the precise location of this invariant point is fixed and the interrelation between the Hf-Cu-Ni cannot be determined from the teachings of the prior art. Applicants have recognized that only these three elements affect the glass forming ability of the quinary alloy; the other elements are primarily added to further decrease the melting point of the alloy, which is not disclosed or taught in the prior art of record.

The Examiner has provisionally rejected Claims 1-34 on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 152-160 of copending Application No. 10/946,132. Both applicants' present application and the copending Application No. 10/946,132 share a common inventor and derive from US Army Research Laboratory sponsored research. The invention of applicants' present application resulted from an alloy development project undertaken at the US Army Research Laboratory. The invention of Application No. 10/946,132 resulted from an outsourced U.S. Army sponsored research effort, undertaken at the completion of applicants' alloy development project. Whereas applicants' claims in the present application relate to the chemically unique nature of the eutectic-type invariant-point-based metallic glass forming alloy composition including Hf, Cu, and Ni, applicants do not disclose or claim the fabrication of bulk components in the present application. However, Claims 152-160 of copending Application No. 10/946,132 relates to the fabrication of bulk components from monolithic alloy compositions as well as their composite derivatives thereof, based upon working with the Hf, Cu, Ni alloy compositions developed by applicants and claimed in the present application (i.e., independent Claims 152-154 relate to forming large monolithic products; Claims 155-157 depend from Claims 152-154, respectively, and additionally specify the alloy to be Hf-based; and Claims 158-160 depend from Claims 152-154, respectively, and additionally recite the Hf-based alloy composition as one of the eutectically derived alloys in the applicants' present application) Thus, applicants'claims are directed to separate and

distinct inventions from Claims 152-160 of copending Application No. 10/946,132. For the above reasons, it is requested that the provisional double patenting rejection be withdrawn.

For the above reasons, Claims 1-39 are believed allowable over the prior art of record, and are not properly subject to a double patenting rejection, and an early notice to such effect is solicited.

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